

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA24 | Birmingham Interchange and Chelmsley Wood

Water resources assessment (WR-002-024)

Water resources

November 2013

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Department
for Transport

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Appendix WR-002-024

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1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

- 1.1.1 The water resources and flood risk assessment appendices comprise three parts. The first of these is a route-wide appendix (Volume 5: Appendix WR-001-000).
- 1.1.2 Specific appendices for each community forum area (CFA) are also provided. For Birmingham Interchange and Chelmsley Wood (CFA24) study area, these are:
- a water resources assessment (i.e. this appendix);
 - a flood risk assessment (Appendix WR-003-024);
 - River Blythe catchment preliminary flow calculations technical report (Appendix WR-004-016); and
 - river modelling of Bayleys Brook (at Marsh Farm and Lavender Hall Lane), the River Blythe Bypass, Shadow Brook and Hollywell Brook technical report (Appendix WR-004-018).
- 1.1.3 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5, Map Book Water resources.

1.2 Study area

- 1.2.1 The study area for this CFA is Birmingham Interchange and Chelmsley Wood, which covers an approximately 4.35km section of the Proposed Scheme in Solihull Metropolitan Borough. It extends from south-east of the A45 Coventry Road, Hampton-in-Arden, at its southern boundary to the administrative boundary between Solihull Metropolitan Borough Council (SMBC) and North Warwickshire Borough Council (NWBC), in close proximity to where the M42 intersects with the M6, at its northern boundary.
- 1.2.2 The route will pass through predominantly agricultural land (the majority of which lies within the Packington Estate) and urban areas. The urban areas relate to Chelmsley Wood, a large residential estate and the Birmingham Interchange area. The Birmingham Interchange area is predominantly an area of employment, which includes: Birmingham Airport; Birmingham International station; the National Exhibition Centre (NEC); Birmingham Business Park and Packington Landfill. The small historic settlements of Middle Bickenhill and Bickenhill are located within Birmingham Interchange.
- 1.2.3 The existing Rugby to Birmingham line runs south-east to north-west through this section of the Proposed Scheme to Birmingham International station, continuing to the north-west towards Birmingham New Street station. Principal roads include: the A452 Chester Road; the A45 Coventry Road; the A446 Stonebridge Road, and the M42.

1.2.4

The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this spatial scope is defined as the study area. The main environmental features of relevance to water resources and flood risk include:

- main rivers of the River Blythe (a designated Site of Special Scientific Interest (SSSI), and Hollywell Brook;
- the floodplain of Hollywell Brook, and the proposed realignment of Hollywell Brook;
- the Coleshill and Bannerly Pools and Bickenhill Meadows SSSI and Hollywell Brook potential Local Wildlife Site (LWS);
- two Secondary A aquifers, the permeable superficial deposits and the Arden Sandstone Formation; and one Secondary B aquifer, the Mercia Mudstone Formation; and
- one licensed groundwater abstraction, which abstracts directly from the Mercia Mudstone Group (most probably from the Arden Sandstone Formation).

2 Stakeholder engagement

2.1.1 Contact and discussion with the following stakeholders has been undertaken to inform the water resources assessment:

- the Environment Agency with regard to the proposed realignment of the Hollywell Brook and flood modelling within the River Blythe catchment; and
- SMBC, NWBC, as Lead Local Flood Authorities (LLFA) and Severn Trent Water Ltd (STW) with regard to surface water drainage and flood risk in the study area and to identify any private groundwater abstractions.

3 Baseline data

3.1 General

3.1.1 The following section provides a current description of water resources including surface water and groundwater.

3.2 Surface water features

3.2.1 All surface water features within the study area of the route, as defined in Section 1 above, are presented in Table 1.

3.2.2 The current surface water baseline is shown on Map WR-01-041 (Volume 5, Map Book Water resources). All surface water features are based on the Environment Agency's digital river network.

3.2.3 Water bodies in this area fall within the Tame, Anker and Mease sub-catchment of the Humber River Basin District (RBD) and associated river basin management plan (RBMP).

3.2.4 The River Blythe is a major tributary of the River Tame and drains parts of North Warwickshire, Solihull and the surrounding rural areas. It has a total catchment of 131 km² upstream of a point on the river 400m north of Patrick Bridge. The River Blythe is located to the east, and downstream, of the centreline of the route of the Proposed Scheme in this study area. At its closest, it will be approximately 600m from the centreline. It is a Main River and as such it is the responsibility of the Environment Agency. The river reach in this area is designated as a SSSI.

3.2.5 The descriptive values ascribed to surface water receptors in Table 1: Surface water features within 1km of the route in CFA24 below have been derived in accordance with the Scope and Methodology Report (SMR), Volume 5: Appendix CT-001-000/1, and its addendum, Volume 5: Appendix CT-001-000/2.

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Table 1: Surface water features within 1km of the route in CFA24

Water feature	Location description	Watercourse Classification ¹	Water Framework Directive ² (WFD) water body and overall status	WFD status objective (by 2027) ³ as per RBMP	Receptor value ⁴	Q95 (m ³ /s)	Catchment/s	Size (km ²)	Notes
River Blythe: Temple Balsall to Patrick Bridge and Patrick Bridge to River Tame.	Located east of the route, south of Packington Landfill and 500m east of the A452 Chester Road.	Main river	Moderate (GB104028042572)	Good	Very high	0.08	Tame, Anker and Mease	131	Tributary of the River Tame. Located east and downstream of the centreline of the route. At its closest point it will be 20m from Stonebridge Island.
Hollywell Brook: tributary of River Blythe.	The route will cross the Brook at approximately 245m east of Middle Bickenhill Lane.	Main river	No status shown in RBMP – assumed status is Moderate	No status shown in RBMP – assumed status is Good	Very high	0.003	Tame, Anker and Mease	6	The source is Pendigo Lake and flows eastwards to confluence with the River Blythe. The route will cross the brook to the east of the NEC between the A452 Chester Road and Middle Bickenhill Lane.

¹ Environment Agency water-feature classification: The Land Drainage Act 1991 defines an Ordinary watercourse as "A watercourse that is not part of a main river, all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows". "Main Rivers" are larger rivers and streams designated by Department for Environment, Food and Rural Affairs (DEFRA); main rivers are regulated by the Environment Agency.

² Water Framework Directive, 2000, Directive 2000/60/EC.

³ Year may vary in different RBMPs.

⁴ For examples of receptor values see Table 43 in the addendum to the SMR.

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Pond	Approximately 270m west of the route at Birmingham Business Park.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourse in catchment shown on mapping.
Pond	Approximately 85m east of the route and 170m west of the M42.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 60m west of the route and 160m south of Coleshill Heath Road.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 90m west of the route and 370m south of Coleshill Heath Road	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 95m east of the route and 150m west of M42.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 55m east of the route and 215m west of the M42.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.

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Pond	Approximately 45m west of the route and 125m west of the M42.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping
Pond	Approximately 580m west of the route at Birmingham Business Park.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 570m west of the route at Birmingham Business Park.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 500m west of the route at Birmingham Business Park.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 470m west of the route at Birmingham Business Park	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 400m west of the route at Birmingham Business Park.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.

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Pond	Approximately 320m west of the route at Birmingham Business Park.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 585 m west of the route near Heath Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 740m west of the route and 150m west of Solihull Parkway.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 725m west of the route and 120m south of Solihull Parkway.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 970m west of the route and 70m west of Pendigo Way.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 975m west of the route and 95m west of Pendigo Way.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.

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Pond	Approximately 985m west of the route and 80m west of Pendigo Way.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Spinney Pool	Approximately 1km west of the route and 105m west of Pendigo Way within the NEC.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pendigo Lake	Approximately 980m west of the route and 40m west of Pendigo Way within the NEC.	Not applicable	Not applicable	Not applicable	High	N/A	Tame, Anker and Mease	N/A	Links to the River Blythe via Hollywell Brook. The lake and brook will be crossed by the people mover.
Pond	Approximately 900m west of the route, north of car parks within the NEC complex.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 740m west of the route north of car parks at the NEC.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 310m east of the route at Denbigh Corner.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.

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Pond	Approximately 590m east of the route at Fishpool Lane.	Not applicable	Not applicable	Not applicable	Very high	N/A	Tame, Anker and Mease	N/A	Linked to the River Blythe.
Pond	Approximately 670m east of the route and 70m west of Siding Wood.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 505m east of the route and 310m north of Siding Wood.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 490m west of the route and 270m north of Siding wood.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 655m east of the route near the dismantled Hampton-in-Arden to Shustoke line at Siding Wood.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 85m east of the route and 240m west of the A452 Chester Road.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.

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Pond	Approximately 85m east of the route and 90m west of the A452 Chester Road.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 50m east of the route and 200m west of the A452 Chester Road.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 50m east of the route and 200m west of the A452 Chester Road.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 890m east of the route at The Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 910m east of the route on the south-east boundary of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 640m east of the route and south of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.

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Pond	Approximately 610m east of the route and south of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Pond	Approximately 655m east of the route and south of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field pond with no links to watercourses in catchment shown on mapping.
Coleshill Pool (consisting of two pools)	Approximately 265m and 430m east of the route in Pool Wood.	Not applicable	Not applicable	Not applicable	Very high	N/A	Tame, Anker and Mease	N/A	Potentially linked to the River Blythe.
Drain	Approximately 650m east of the route at refuse tip in the Packington landfill area.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 710m east of the route in the Packington Landfill area.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 715m east of the route in the Packington Landfill area.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.

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Drain	Approximately 375m east of the route and 230m north-east of Melbicks Garden & Leisure centre.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 400m east of the route and 165m north-east of Melbicks Garden & Leisure centre.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 560m east of the route south of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 610m east of the route south of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 675m east of the route south of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 750m east of the route south of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.

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Drain	Approximately 955m east of the route and east of Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field drain that drains into River Blythe
Drain	Approximately 405m east of the route and north-west of Brickhill Street Farm, near the M42 junction 7a.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field drain that potentially drains into River Cole.
Drain	Approximately 820m east of the route at The Bogs Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Isolated field drain that potentially drains into River Blythe.
Drain	Approximately 980m west of the route on the eastern boundary of Bickenhill Plantations.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 735m west of the route at car parks north of the NEC.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 470m west of the route at car parks north of the NEC.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.

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Drain	Approximately 285m west of the route along North Way near the roundabout on Bickenhill Parkway.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 820m west of the route and west of Heath Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 735m west of the route and west of Heath Farm.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 955m east of the route and north-east of Packington Landfill.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.
Drain	Approximately 980m east of the route and north-east of Packington Landfill.	Not applicable	Not applicable	Not applicable	Low	N/A	Tame, Anker and Mease	N/A	Field drain with no direct links to watercourses in catchment shown on mapping.

3.2.6 There are no licensed surface water abstractions within 1km of the route.

3.2.7 Table 2 shows surface water discharge consents within 1km of the route.

Table 2: Surface water discharge consents

Permit identifier	Distance from route (m)	Discharge type	Receiving water body
T/11/36088/T	Approximately 40m west of the route and 205m south of the A45 Coventry Road. (WR-01-041, H6)	Trade effluent discharge - site drainage	N/A
T/11/20627/T	Approximately 950m east of the route located at Packington Landfill. (WR-01-041, F4)	Trade effluent discharge - site drainage	N/A
T2517/1	Approximately 480m west of the route and 35m east of the M42. (WR-01-041, G6)	Sewage treatment works - final effluent	Hollywell Brook
T/11/10367/S/1	Approximately 145m west of the route and 75m south of the A45 Coventry Road. (WR-01-041, H6)	Sewage treatment works - final effluent	Hollywell Brook
T/11/35473/T	Approximately 220m west of the route and 120m south of the A45 Coventry Road. (WR-01-041, H6)	Trade effluent discharge - site drainage	N/A
T/12/35929/S	Approximately 135m west of the route and 65m south of the A45 Coventry Road. (WR-01-041, H6)	Sewage discharges - final/treated effluent - not water company	N/A

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Permit identifier	Distance from route (m)	Discharge type	Receiving water body
T/11/03727/S	Approximately 595m east of the route located at the eastbound A45 Coventry Road exit at Stonebridge Island. (WR-01-041, H4)	Sewage discharges - final/treated effluent - not water company	River Blythe

3.3 Groundwater

- 3.3.1 There are two categories of aquifer identified within the study area. The Arden Sandstone and the Glaciofluvial Deposits, Glaciolacustrine Deposits, river deposits and alluvium are classified as Secondary A aquifers and Mercia Mudstone is classified as a Secondary B aquifer.
- 3.3.2 There are no groundwater source protection zones located within the study area. Baseline information is shown on Maps WR-02-024, WR-03-040 and WR-03-041, Volume 5, Map Book Water resources.
- 3.3.3 There are known areas of Made Ground identified within the study area which are associated with infrastructure development including material from the construction of the M42, earthworks associated with the dismantled Hampton-in-Arden to Shustoke line at Middle Bickenhill, excavated material from a balancing pond to the west of Middle Bickenhill Lane, a borrow pit from the construction of the M42 between the M42 and Middle Bickenhill Lane and deposits to the west of the M42 associated with the construction of the NEC, Birmingham International station and Birmingham Airport.
- 3.3.4 Superficial glacial deposits are present across much of the study area. Most of the glacial deposits which will be beneath the route are sands and gravels. These are extensive but not continuous beneath the axis of the River Blythe valley and constitute a significant local aggregate resource. A dissected layer of glacial till (generally a brown silty or sandy clay) overlies the glacial sand and gravel which is generally a firm to stiff brown silty or sandy clay with many clasts of quartzite. Fluvial/alluvial deposits are present across lower parts of the River Blythe and stream valleys. A discontinuous cover of superficial glacial deposits (mainly sand and gravels) and very locally alluvium are located in close proximity to the proposed people mover.
- 3.3.5 Mercia Mudstone underlies much of the study area. Mercia Mudstone typically comprises weak red brown silty mudstone with minor amounts of carbonate and gypsum when unweathered. Occasional beds of dolomitic siltstone occur within the Mercia Mudstone which are generally thin and when unweathered are a medium strong rock. Within the Mercia Mudstone sequence, in the vicinity of the people mover, a thicker horizon of interbedded sandstone, siltstone and mudstone, known as the Arden Sandstone Member occurs (see Map WR-02-024, Volume 5, Map Book Water resources).
- 3.3.6 Table 3 summarises the licensed groundwater abstractions within 1km of the route.

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Table 3: Licensed groundwater abstractions

Permit ID (map reference number and Environment Agency reference)	Distance from route (m)	Abstraction horizon	Max annual abstraction quantity (m ³ /yr)	Max daily abstraction quantity (m ³ /d)	Number of boreholes
03/28/11/0081 Melbicks Garden & Leisure centre	Borehole 1: 30m east; and Borehole 2: 110m east (WR-01-041, F5)	Mercia Mudstones	Unknown	Unknown	2

3.3.7 Table 4 summarises groundwater discharge consents within 1km of the route.

Table 4: Groundwater discharge consents

Reference no.	Permit Identifier	Distance from route (m)	Discharge type	Receiving water body
Office development at Quartz Point, A446 Stonebridge Road, Coleshill	Npswqdo01188	Approximately 300m, north-east near the A452 Chester Road/ A446 Stonebridge Road roundabout (WR-01-041, F5)	Sewerage discharge (final/treated effluent)	Land/soakaway
Arden Restaurant and Motel Ltd, A45 Coventry Road, Bickenhill, Solihull	3/28/11/2634/1	Approximately 430m south-west, near the people mover (WR-01-041, H6)	Sewerage discharge (sewage effluent)	Groundwater

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Reference no.	Permit Identifier	Distance from route (m)	Discharge type	Receiving water body
The Arden Hotel, A45 Coventry Road, Bickenhill	T/11/14382/SG/1	Approximately 70m south-west, near the people mover (WR-01-041, H6)	Sewerage discharge (final effluent)	Groundwater
Coleshill Highways Depot, Heath Road, Coleshill	T/11/14167/Sg	Approximately 130m east, near M6 Junction 7aM42 (WR-01-041, D5)	Sewerage discharge (final effluent)	Land/soakaway

3.4 Groundwater/surface water interaction

3.4.1 Locations where surface waters are in direct hydraulic continuity with groundwater and are within 1km of the route and construction activities with the potential to affect groundwater flow and quality are summarised in Table 5.

Table 5: Groundwater/surface water interaction

Location description	Distance from route (m)	Formation	Elevation mAOD	Comments
River Blythe	Approximately 500m east	Permeable superficial deposits	85	Site specific information on dependence is not available. Assumed connection though permeable superficial deposits. Further pre-construction assessment required.
Middle Bickenhill	Approximately 280m north-east	Mercia Mudstone	85	No further assessment is required.
Jacksons Brickworks near Pasture Farm spring	Approximately 190m south-west	Mercia Mudstone	94	No further assessment is required.
Park Farm spring	Approximately 550m south-west	Mercia Mudstone	95	No further assessment is required.
Pendigo Lake spring	Approximately 1,025m south-west	Arden Sandstone skerries	90	No further assessment is required.
M6 junction 7a M42 spring	Approximately 300m east	Mercia Mudstone	93	No further assessment is required.

3.5 Water dependent habitats

- 3.5.1 Table 6 summarises the water dependent habitats within 1km of the route and construction activities with the potential to affect groundwater flow and quality. Bickenhill Meadows SSSI is located 1.4km from construction activities with the potential to affect water flow and quality and is not assessed.
- 3.5.2 The table identifies where a groundwater dependency exists. The assessment of the impact on groundwater dependent ecology receptors is found in Ecology, Volume 2, CFA Report 24, Birmingham Interchange and Chelmlsey Wood (CFA Report 24), Section 7 and Volume 5: Appendix EC-007-024.

Table 6: Description of water dependent habitats

Location	Distance from route (m)	Designation	Comments
River Blythe SSSI	Approximately 500m east of route	Marshy grassland	<p>This designated site contains wetland areas, which are considered to be at least partially groundwater dependent and therefore to be groundwater dependent terrestrial ecosystems (GWDTEs)</p> <p>Site specific information on dependence is not available. Assumed connection though permeable superficial deposits. Further pre-construction assessment required.</p>
Coleshill and Bannerly Pools SSSI	Approximately 180m east of route	Fens and swamp	<p>According to Natural England records, the Coleshill and Bannerly Pools are predominantly fed by groundwater contributions from a perched water table⁵ in the underlying sand and gravel deposits, rather than the surrounding surface water catchment or the underlying Mercia Mudstones⁶.</p> <p>Site specific information on dependence is not available. Assumed connection though permeable superficial deposits. Further pre-construction assessment required.</p>

⁵ Aspinwall & Company (1995). *National Rivers Authority Hydrogeological Assessment of Sites of Special Scientific Interest; Final Report: Coleshill and Bannerly Pools, SP200 860, Warwickshire*. National Rivers Authority.

⁶ Bennett, S. (1997). *Coleshill and Bannerly Pools*. Letter to English Nature Warwickshire Office.

4 Site specific assessments

4.1 Surface water

4.1.1 Table 7 summarises the potential impacts and effects to surface water. It only includes surface water features which could potentially be impacted by the Proposed Scheme. Features such as isolated ponds and drains which lie outside the construction footprint and area of impact of the Proposed Scheme are not included. Where the ecology of a water feature is impacted this is assessed and presented within the Ecology assessment (see Volume 2, Section 7, Birmingham Interchange and Chelmlsey Wood (CFA Report 24)).

Table 7: Summary of potential impacts to surface water

Water feature / receptor	Value of water feature	Design element	Potential impact to water receptor	Magnitude of potential impact (no mitigation)	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Hollywell Brook, River Blythe SSSI and tributaries, Coleshill and Bannerly Pools. Unnamed watercourse at Denbigh Spinney	Very high	Rail and associated infrastructure	Potential impact on water quality and flow of run-off from construction areas.	Moderate adverse (Significant)	Draft CoCP Section 16 regarding control of site drainage from earthworks and construction sites. Procedures to follow BS6031 ⁷ Code of Practice for Earthworks.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction temporary
Hollywell	Very	Birmingham	Potential	Moderate	Draft CoCP Section	Negligible	None	Negligible impact	Construction

⁷ British Standards Institute (BSI) (2009), *BS6031 Code of practice for earthworks*. London, BSI.

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Water feature / receptor	Value of water feature	Design element	Potential impact to water receptor	Magnitude of potential impact (no mitigation)	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Brook, unnamed watercourse at Denbigh Spinney, and River Blythe SSSI.	High	Interchange Station, and parking, roads alterations/construction	impact on water quality and flow of run-off from construction areas.	Adverse (Significant)	16 regarding control of site drainage from earthworks and construction sites. Procedures to follow BS6031 Code of Practice for Earthworks.	Neutral effect (Not significant)	required	Neutral effect (Not significant)	temporary
Pendigo Lake, Hollywell Brook, and River Blythe SSSI.	Very high	Construction of the people mover.	Potential impact on water quality and flow of run-off from construction areas.	Moderate Adverse (Significant)	Draft CoCP Section 16 regarding control of site drainage from earthworks and construction sites. Procedures to follow BS6031 Code of Practice for Earthworks.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction temporary
Hollywell Brook, unnamed watercourse at Denbigh Spinney, and River Blythe SSSI.	Very high	Road alterations and construction of new roads.	Potential impact on water quality and flow of run-off from construction areas.	Moderate Adverse (Significant)	Draft CoCP Section 16 regarding control of site drainage from earthworks and construction sites, and procedures to follow BS6031: 2009 Code of Practice for Earthworks.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction temporary

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Water feature / receptor	Value of water feature	Design element	Potential impact to water receptor	Magnitude of potential impact (no mitigation)	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
Hollywell Brook	Very high	Works associated with the Hollywell Brook realignment.	Impact on surface water flow. Increase in flood risk due to construction phase activities within areas at risk of flooding inadvertently displacing floodwaters.	Moderate Adverse (Significant)	As above, together with naturalisation measures within the watercourse such as pools, soft shelves and banks.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction temporary
Hollywell Brook, unnamed watercourse at Denbigh Spinney and agricultural ditch near the A45 Coventry Road	Very high	River realignments: Hollywell Brook, Denbigh Spinney watercourse and agricultural ditch near the A45 Coventry Road.	Potential impact on water quality from run-off and sediments.	Minor adverse (Significant)	As above, together with naturalisation measures within the watercourse such as pools, soft shelves and banks.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction temporary
Hollywell Brook, unnamed watercourse at Denbigh Spinney and agricultural ditch near	Very high	River realignments: Hollywell Brook, Denbigh Spinney watercourse and agricultural ditch near the A45 Coventry Road.	Potential impact to flow	Minor adverse (Significant)	Design measures to ensure channel capacity/form of channel replicated, together with naturalisation measures within the watercourse	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction permanent

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Water feature / receptor	Value of water feature	Design element	Potential impact to water receptor	Magnitude of potential impact (no mitigation)	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
the A45 Coventry Road					such as pools, soft shelves and banks.				
Hollywell Brook, unnamed watercourse at Denbigh Spinney and agricultural ditch near the A45 Coventry Road.	Very high	New roads, road alterations and Birmingham Interchange station car parks.	Road and car park drainage introducing heavy metals and other contaminants to watercourses.	Minor adverse (Significant)	Use of Sustainable Drainage Systems (SuDS) and balancing ponds to reduce contaminants in run-off before discharge to local watercourses.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction permanent
Hollywell Brook, unnamed watercourse at Denbigh Spinney, River Blythe SSSI	Very high	Track maintenance activities and routine run-off.	Run-off of contaminants from track drainage.	Minor adverse (Significant)	Use of best practice measures will be used during the operation and maintenance of the route. This will provide effective management and control of impacts during the operational phase.	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction permanent
Unnamed watercourse at Denbigh Spinney	Very high	Culverts for access roads	Increase in culverted sections of watercourse on Denbigh Spinney	Negligible (Not significant)	None possible	Negligible impact Neutral effect (Not significant)	None required	Negligible impact Neutral effect (Not significant)	Construction permanent

Water feature / receptor	Value of water feature	Design element	Potential impact to water receptor	Magnitude of potential impact (no mitigation)	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
			watercourse. Resulting in localised reduction of natural light and inhibiting photosynthesis in watercourse.						
Hollywell Brook	Very high	Birmingham Interchange station	Localised reduction in natural light level to water column where Hollywell Brook will pass under the Birmingham Interchange station platforms inhibiting photosynthesis in the watercourse.	Negligible impact Neutral effect (Insignificant)	Openings in bridge over watercourse to north and south of tracks to allow more light.	Negligible impact Neutral effect (Insignificant)	None required	Negligible impact Neutral effect (Not significant)	Construction permanent
Isolated ponds	Low	Rail and associated infrastructure	Four ponds located within construction footprint, may be lost during construction	Moderate adverse	Any pond with significant ecological value will be mitigated. These are assessed and presented within the ecology	Negligible impact Neutral Effect (not significant)	None required	Negligible impact Neutral Effect (not significant)	Construction (permanent)

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Water feature / receptor	Value of water feature	Design element	Potential impact to water receptor	Magnitude of potential impact (no mitigation)	Avoidance and mitigation measures	Magnitude of remaining impact and effect	Other mitigation measures	Residual effect	Duration of effect
					assessment (see Volume 2, Section 7, CFA24)				

4.2 Detailed assessment

The assessment of highway drainage

- 4.2.1 The Highways Agency Water Risk Assessment Tool (HAWRAT) has been used to undertake an assessment of the potential impact to water resources from planned road changes as a result of the construction of the Birmingham Interchange station and related infrastructure. This modelling tool has been used to assess the effects of highway run-off to the Hollywell Brook and the River Blythe following mitigation through the proposed balancing ponds. The assessment concluded that there will be no significant increase of water pollution or spillage risk as a result of the Proposed Scheme.

4.3 Groundwater

- 4.3.1 Table 8 summarises the potential impacts to groundwater, abstractions, and GWDTE and groundwater/surface water interaction during construction. An assessment of the impact on the WFD status is detailed within the WFD Compliance Assessment, contained within the route-wide appendix (Volume 5: Appendix WR-001-000).

Table 8: Summary of potential impacts to groundwater, abstractions, GWDTE and groundwater/surface water interactions

Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
River Blythe SSSI	Very high	Diddington cutting	Temporary dewatering affecting groundwater levels and quality.	Minor adverse (Significant)	Draft CoCP section 16 concerning wastewater and groundwater best practice measures. Remove or breakthrough, install cut-off structures around	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary

Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
					excavations; Ensure cut-off structures are driven to sufficient depths to meet an underlying strata of zone of lower permeability; Promote groundwater recharge, such as by discharging pumped water to recharge trenches, around excavations to maintain baseline groundwater conditions.				
		Bickenhill cutting		Negligible (Insignificant)	Draft CoCP Section 16, as above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary
		Areas of dig out and replace under embankment near		Minor adverse (Significant)	Draft CoCP Section 16, as above	Negligible impact Neutral effect	None	Negligible impact Neutral effect	Construction temporary

Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
		Hollywell Brook				(Insignificant)		(Not significant)	
		Below ground construction sites and structures including, area of dig out and replace near Hollywell Brook and piling for e.g. Pasture Farm accommodation overbridge, people mover depot, A45 Service Road overbridge, A45 Coventry road overbridge, East Way overbridge and Hollywell Brook underbridge.	Barriers of low permeability affecting groundwater levels and quality.	Minor adverse (Significant)	Draft CoCP Section 16, as above	Negligible impact Neutral (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary
Coleshill and Bannerly Pools SSSI	Very high	SSSI located >1km from Diddington cutting, Bickenhill cutting and Hollywell Brook area of dig out and replace. Piling associated with M42 viaduct 180m from SSSI.	Temporary dewatering and barriers to flow unlikely to affect groundwater levels and quality at SSSI.	Negligible (Insignificant)	Draft CoCP Section 16, as above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary

Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
Permeable superficial deposits, Mercia Mudstone and Arden Sandstone, and springs	Moderate	Diddington cutting	Temporary dewatering affecting groundwater levels and quality.	Minor adverse (Insignificant)	Draft CoCP Section 16, as above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary
		Bickenhill cutting		Minor adverse (Insignificant)	Draft CoCP Section 16, as above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary
		Area of dig out and replace under embankment near Hollywell Brook.		Minor adverse (Insignificant)	Draft CoCP Section 16, as above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary
		Below ground construction sites and structures including area of dig out and replace near Hollywell Brook and piling for e.g. Pasture Farm accommodation overbridge, people mover depot, A45 Service Road overbridge, A45	Barriers of low permeability affecting groundwater levels and quality.	Minor adverse (Insignificant)	Draft CoCP Section 16, as above	Negligible impact Neutral (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary

Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
		Coventry Road overbridge, East Way overbridge and Hollywell Brook underbridge.							
Groundwater user - Melbicks Garden & Leisure centre	High	Groundwater user located >1km from Diddington cutting, Bickenhill cutting and Hollywell Brook area of dig out and replace. Piling associated with M42 viaduct 190m from groundwater user.	Temporary dewatering and barriers to flow unlikely to affect groundwater levels and quality of groundwater user.	Negligible (Insignificant)	Draft CoCP Section 16, as above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction temporary
River Blythe SSSI	Very high	Diddington cutting	Permanent groundwater control affecting groundwater levels and quality.	Minor adverse (Significant)	Draft CoCP Section 16 and remove or breakthrough cut-off structures following construction, incorporate passive bypasses within the design, incorporate collars in these passive bypasses to avoid creating artificial flow paths, implement a regime of post construction	Negligible impact Neutral (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction permanent

Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
					monitoring of groundwater levels				
		Below ground construction sites and structures including piling for e.g. Pasture Farm accommodation overbridge, people mover depot, A45 Service Road overbridge, A45 Coventry Road overbridge, East Way overbridge and Hollywell Brook underbridge.	Barriers of low permeability affecting groundwater levels	Minor adverse (Significant)	As above	Negligible impact Neutral (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction permanent
Coleshill and Bannerly Pools SSSI	Very high	SSSI located >1km from Diddington cutting, Bickenhill cutting and Hollywell Brook area of dig out and replace. Piling associated with M42 viaduct 180m from SSSI.	Permanent groundwater control and barriers to flow unlikely to affect groundwater levels and quality at SSSI.	Negligible (Insignificant)	As above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction permanent
Permeable superficial deposits, Mercia	Moderate	Diddington cutting	Permanent groundwater control	Minor adverse (Insignificant)	As above	Negligible impact	None	Negligible impact Neutral effect	Construction permanent

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Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
Mudstone and Arden Sandstone, and springs			affecting groundwater levels and quality			Neutral effect (Not significant)		(Not significant)	
		Bickenhill cutting		Minor adverse (Insignificant)	As above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction permanent
		Below ground construction sites and structures including piling for e.g. Pasture Farm accommodation overbridge, people mover depot, A45 Service Road overbridge, A45 Coventry Road overbridge, East Way overbridge and Hollywell Brook underbridge.	Barriers of low permeability affecting groundwater levels	Minor adverse (Insignificant)	As above	Negligible impact Neutral effect (Not significant)	None	Negligible impact Neutral effect (Not significant)	Construction permanent
Groundwater user - Melbicks Garden & Leisure centre	High	Groundwater user located >1km from Diddington cutting, Bickenhill cutting and Hollywell Brook area	Permanent groundwater control and barriers to flow unlikely to	Negligible (Insignificant)	As above	Negligible impact Neutral effect	None	Negligible impact Neutral effect	Construction permanent

Water feature / receptor	Value of water feature	Design element	Discussion of potential impact to water receptor	Magnitude of potential impact	Mitigation measures included in design	Magnitude of remaining impact and significance of effect	Further mitigation	Residual effect	Duration of effect
		of dig out and replace. Piling associated with M42 viaduct 190m from groundwater user.	affect groundwater levels and quality of groundwater user.			(Not significant)		(Not significant)	

4.4 Detailed assessment

Groundwater assessment of the cuttings/excavations

4.4.1 Table 9 summarises the excavations and the requirement for groundwater control. Only those impacts and effects that are classed as significant are presented in the Volume 2, CFA Report 24, Section 13.4, Birmingham Interchange and Chelmlsey Wood (CFA Report 24).

Table 9: Summary of cuttings/excavations and requirement for groundwater control

Cutting name and depth	Geology penetrated	Groundwater elevation	Potential impact on groundwater resources	Mitigation	Residual Significance
Diddington cutting	Made Ground over Mercia Mudstone Formation and Arden Sandstone	Cutting below water strike	Interception of Mercia Mudstone/Arden Sandstone groundwater	Pre-construction monitoring to confirm If required, mitigation includes temporary and permanent groundwater control	Not significant

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Cutting name and depth	Geology penetrated	Groundwater elevation	Potential impact on groundwater resources	Mitigation	Residual Significance
Bickenhill cutting near people mover	Clay over Mercia Mudstone Formation	No water strike	Interception of groundwater unlikely	Pre-construction monitoring to confirm If required, mitigation includes temporary and permanent groundwater control	Not significant
Bickenhill cutting	Sand and gravel over Mercia Mudstone Formation	No water strike	Interception of groundwater unlikely	Pre-construction monitoring to confirm If required, mitigation includes temporary and permanent groundwater control	Not significant
Area of dig out and replace under Bickenhill embankment near Hollywell Brook	Sand and gravel over Mercia Mudstone Formation	No water strike	Interception of groundwater unlikely	Pre-construction monitoring to confirm If required, mitigation includes temporary and permanent groundwater control	Not significant
Cutting near interchange concourse and forecourt	Sand and gravel over Mercia Mudstone Formation	No water strike	Interception of groundwater unlikely	Pre-construction monitoring to confirm If required, mitigation includes temporary and permanent groundwater control	Not significant

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